treatment should be repeated. The intraspinal, of course, gives temporary increase of symptoms and steep elevation of temperature but this fact need not of itself cause alarm. If after this treatment the patient holds his own or improves the intraspinal need not be repeated but the daily injection of antitoxin intravenously should be given until obvious remission or cure results.

The severity of the cases will, of course, vary and the resulting treatment will depend on this factor. Attention is called to Case VIII, who received a total of 169,000 units, which included 29,000 units given intraspinally in six sessions, in this case, daily, although I doubt if this frequency is often indicated.

The series of cases I have reported is, of course, small, and I am fully aware of the dangers of deducing results from such small material. On the other hand, I have the impression, though I find it hard to put into words, that, although many of these cases were of the severest type and very ill, we had, particularly in the intraspinal method, complete control of the situation. With this feeling of confidence, therefore, I should hesitate to offer any other method of treatment until there is better evidence of the superiority of these other methods.

THE PATHOLOGIC CHANGES IN THE SYMPATHETIC SYSTEM IN GOITER.*

By Louis B. Wilson, M.D.,
ROCHESTER, MINNESOTA.

The amount and character of the pathologic changes in the sympathetic ganglia removed at operation or at autopsy from patients with exophthalmic goiter have been studied by other observers, meagerly and rarely by modern methods. I have reviewed elsewhere[1] the literature of previous reports. So far as the findings have been positive, they have shown that in exophthalmic goiter the cells of the sympathetic ganglia exhibit various stages of degeneration. The paucity and incompleteness of the reported observations, however, together with Cannon's[2] recent experimental production of some of the symptoms of exophthalmic goiter in cats by constant stimulation of the thyroid through the sympathetic system, have warranted a more careful study of the material accumulating in the Mayo Clinic.

* Read before the Association of American Physicians, Washington, D. C., May 10, 1916.

Previous Report in the Present Series of Observations.

Durante and I[1] have recently reported our observations on twenty superior cervical sympathetic ganglia removed at operation from sixteen patients with hyperplastic toxic (exophthalmic) goiter. Our findings may be briefly summarized as follows:

1. Definite histologic changes in the cells of the cervical sympathetic ganglia in hyperplastic toxic (exophthalmic) goiter occurred in all cases examined.

2. These histologic changes consisted of various stages of degeneration, namely (*a*) hyperchromatization, (*b*) hyperpigmentation, (*c*) chromatolysis, and (*d*) atrophy or (*e*) granular degeneration of the nerve cells.

3. Some of the ganglia contained cells resembling the partially differentiated cells found in the ganglia of infants.

4. Accompanying the more advanced changes in the ganglion cells were similar degenerative changes in the nerve fibers and an increase of connective tissue throughout the ganglion, but especially in the outer and middle coats of the vessels and in the periganglionic tissue.

5. So far as could be determined from the small number of observations, the pathologic changes in the cervical sympathetic ganglia were parallel to the stage and intensity of the symptoms of hyperthyroidism and to the hyperplastic and regressive changes in the thyroid.

Material for the Present Study.

The present report is based on a study of the cervical and other sympathetic ganglia removed at autopsy from twelve patients dying during the course of exophthalmic goiter. The observations have been controlled by similar studies on sympathetic ganglia removed at autopsy from nine patients dying of diseases other than exophthalmic goiter, and by studies on gasserian ganglia removed at operation from six patients with trifacial neuralgia.

All ganglia removed at operation were fixed within five minutes after removal, and the material from autopsies was fixed within three hours after death. Some portions of ganglia were examined in frozen sections of the fresh tissue. The remainder of the specimen or specimens was fixed in 10 per cent. formalin. Selected blocks were cut frozen without embedding and the sections stained with Sudan III or by Nissl's method. Other blocks were embedded in paraffin and cut in serial sections, which were stained with hematoxylin-eosin, by Weigert-van Geison's method for connective tissue, by Weigert-Luden's method for myelin,[3] and by Held-Nissl's method for distribution of chromatin. Other blocks were used for silver impregnation by Ramon y Cajal's,[4] Levaditi's,[5] or Bielschowsky's methods. Others were fixed and stained by

Bensley's[6] acetic-osmic-bichromate method for mitochondria. The most satisfactory results were obtained by the use of Sudan III, Held-Nissl's, Ramon y Cajal's, and Bensley's stains.

Protocols.

Case 1 (A156,845).—The patient was a female, nineteen years of age, who had had severe symptoms of hyperplastic toxic goiter for five months. Recently the thyroid had enlarged very rapidly. The patient died of hyperthyroidism a few days after coming to the Clinic, without having been operated on. At autopsy, three hours and forty minutes after death, there was found marked hyperplasia of the thyroid, marked exophthalmos, symmetrical brown pigmentation of the conjunctivæ, marked emaciation, petechial hemorrhages in the skin, in the parietal peritoneum of the true pelvis, and elsewhere in the pelvic organs, marked hypertrophy of the myocardium of the left ventricle, slight nodular sclerosis of the coronary arteries, and fatty changes in the intima. The thymus weighed 80 grams.

Microscopically, the thyroid showed progressive advanced hypertrophy and hyperplasia, Type B[7]. The superior cervical ganglia showed very marked hyperpigmentation and extensive granular degeneration of the cells, many of which were atrophic or consisted of only small masses of pigment.

Case 2 (A153,535).—The patient was a female, nineteen years of age; for five months had shown symptoms of severe exophthalmic goiter. The systolic blood-pressure was 180, diastolic 75, pulse-rate 150 to 168. After two weeks' preparation the left superior thyroid vessels were ligated. The temperature remained normal and the pulse fluctuated from 100 to 118. Death occurred three days after operation. The macroscopic findings at autopsy, made three hours and fifteen minutes after death, were those of severe exophthalmic goiter.

Microscopically, the thyroid showed progressive advanced hypertrophy and hyperplasia, Type B[7]. Many of the cells from the cervical sympathetic ganglia were in the state of advanced degeneration noted in Case 1, though not nearly so many cells were affected (Fig. 1).

Case 3 (A144,809).—A female, thirty years of age; had had severe symptoms of exophthalmic goiter for eight months. At the time of examination the systolic blood-pressure was 165, diastolic 70, and pulse-rate 128. The left superior thyroid vessels were ligated, and four months later the right superior thyroid vessels were also ligated. Two weeks after the second ligation the right lobe, isthmus, and pyramidal lobe of the thyroid were extirpated. Death occurred the following day. At autopsy, two hours and thirty minutes after

death, an advanced chronic myocarditis with fatty degeneration and advanced degenerative changes in the liver and kidneys were found.

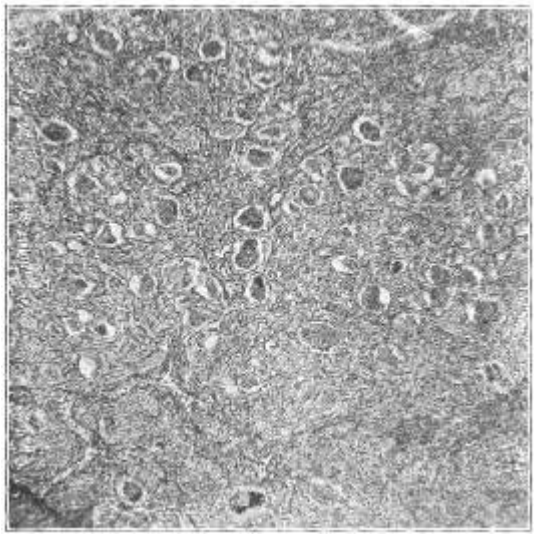

FIG. 1 (Case 2).—Section of left superior cervical sympathetic ganglion, silver impregnation, 5 microns, × 120 diameters. Advanced degeneration of many cells.

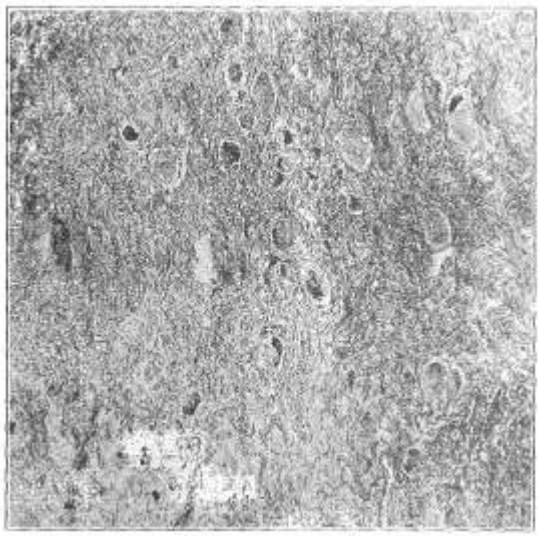

FIG. 2 (Case 3).—Section of left superior cervical sympathetic ganglion, silver impregnation, 5 microns, × 120 diameters. A few normal cells, many showing advanced degeneration.

Microscopically, the thyroid showed early regressive advanced hypertrophy and hyperplasia, Type C–1[7]. In the cervical sym-

pathetic ganglia a few cells were apparently normal. Many showed varying degrees of hyperpigmentation and granular degeneration (Fig. 2).

CASE 4 (A136,418).—The patient, a female, twenty-five years of age, had shown symptoms of exophthalmic goiter for two years, with marked increase in severity during the last three weeks. At the time of examination the systolic blood-pressure was 145, and diastolic 80. The left superior thyroid vessels were ligated, and five days later the right superior vessels were ligated also. Four and a half months later the right lobe, isthmus, and a small portion of the left lobe of the thyroid were resected. The patient died nine days after the operation. At autopsy, eight hours after death,

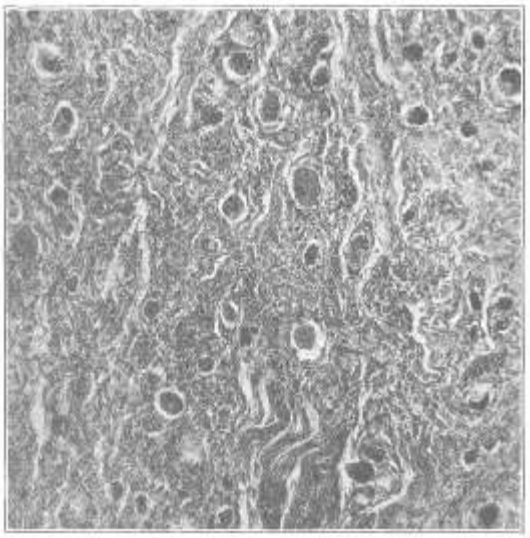

FIG 3 (Case 4).—Section of right superior cervical sympathetic ganglion, silver impregnation, 10 microns, × 120 diamters. A few normal cells, many in varying stages of degeneration.

the macroscopic findings were a hypertrophied thymus, acute myocardial degeneration, and dilatation of the heart, congestion and degeneration of all parenchymatous organs, and severe purulent bronchitis. The cervical sympathetic ganglia were noticeably enlarged.

Microscopically, the thyroid showed early regressive advanced parenchymatous hypertrophy and hyperplasia, Type C–1[7]. The ganglia showed a few fairly normal cells, but many others in varying stages of degeneration (Fig. 3).

CASE 5 (A11,264).—This patient was a female, thirty-three years of age, who had had symptoms of exophthalmic goiter beginning two years and five months previously. At the time of examina-

tion the systolic blood-pressure was 138, diastolic 90, and pulse-rate 138. The left superior thyroid vessels were ligated, and two weeks later the right superior thyroid vessels were ligated. Two and three months after the last ligation, hot-water injections were made into each lobe of the thyroid, and three weeks after this, or four and a half months after the first ligation, the right lobe and isthmus of the thyroid were extirpated. The patient's pulse-rate increased to 140, and she died twenty-four hours after the operation. At autopsy, two hours and thirty minutes after death, the principal macroscopic findings were acute and chronic myocardial degeneration, with a dilated heart, general parenchymatous degeneration not so severe as usual in exophthalmic goiter, and chronic nephritis.

Microscopically, the thyroid showed early regressive advanced hypertrophy and hyperplasia, Type C–1[7]. A few cells in the cervical sympathetic ganglia were normal. Many showed varying degrees of hyperpigmentation and granular degeneration.

CASE 6 (A149,095).—The patient, a female, twenty-eight years of age, had shown symptoms of exophthalmic goiter for six years, with a maximum severity within the first year. At the time of examination she had slight exophthalmos, a systolic blood-pressure of 150, a diastolic of 80, and a pulse-rate of 120. The left superior thyroid vessels were ligated, and two weeks later hot-water injections were made into the right lobe of the thyroid. One week after this the right superior thyroid vessels were divided and the ends ligated separately. Two weeks after the last operation the patient died. At autopsy, one hour after death, the principal macroscopic findings were bilateral lobar pneumonia with infarction of right upper lobe and hypertrophy and dilatation of the heart.

Microscopically, the thyroid showed a regressing advanced hypertrophy and hyperplasia, Type C–2[7]. The cervical sympathetic ganglia showed many cells apparently normal, a few in advanced stages of degeneration, and a very few in intermediate stages of degeneration.

CASE 7 (A-135,172).—The patient, a female, twenty-nine years of age, had had goiter for sixteen years, with moderate symptoms of thyrotoxicosis for twelve years, the maximum severity of toxic symptoms having been attained about four years ago, since which time there had been some abatement. At the time of examination the systolic blood-pressure was 175, the diastolic 78, and the pulse-rate 114. The left and right superior thyroid vessels were ligated, and four months later the right lobe, isthmus, and a small piece of the left lobe of the thyroid were extirpated. The patient died one week after operation. At autopsy, two hours after death, the macroscopic findings were an hypertrophied thymus, bilateral emphysema, acute splenitis, and chronic nephritis, with congestion.

Microscopically, the thyroid showed advanced regressive changes on chronic hypertrophy and hyperplasia, Type C–2[7]. The superior

cervical sympathetic ganglia showed many cells apparently normal and a few in advanced stages of degeneration. The total number of cells was apparently much reduced (Fig. 4).

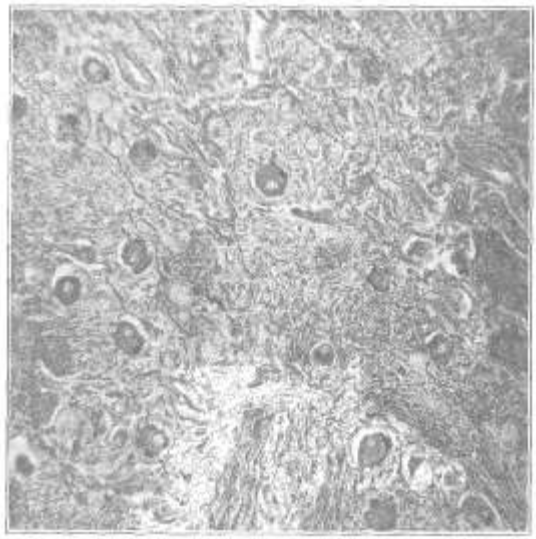

FIG. 4 (Case 7).—Section of right superior cervical sympathetic ganglion, silver impregnation, 5 microns, × 120 diameters. Marked reduction in the number of cells, many apparently normal, and a few in advanced stages of degeneration.

CASE 8 (A109,170).—This patient, a female, forty-seven years of age, had noticed enlargement of the thyroid for four years, but symptoms ascribable to thyrotoxicosis began only one year prior to the enlargement. At the time of examination the systolic blood-pressure was 140, diastolic 45, and pulse-rate 120. The right and left superior thyroid vessels were ligated. The patient improved steadily in health for eight or nine months, and then began to lose appetite, weight, and strength. A year after the first operation, several hot-water injections into the thyroid were made. The general health improved, but there was a rise in blood-pressure to 166 systolic, 90 diastolic, and a rise in pulse-rate to 140, six months after the injections. One month later the pulse-rate was 176. Death occurred a month after this, or one year and eight months after the first operation,. At autopsy, three hours after death, the macroscopic findings were hypertrophy and dilatation of the heart, chronic cholecystitis, and parenchymatous degeneration of all organs.

Microscopically, the thyroid showed advanced regression on an old parenchymatous hypertrophy and hyperplasia, Type C–3[7]. The superior cervical sympathetic ganglia showed a great reduction in the total number of cells, many of the remaining ones of which,

however, were normal, while a few were in advanced stages of granular degeneration.

CASE 9 (A-147,479).—The patient, a female, forty-four years of age, had had thyroid enlargement for thirty-two years, with symptoms of thyrotoxicosis beginning five years ago and gradually increasing to the present time. At the time of examination the patient had lost weight from 150 to 114 pounds. The systolic blood-pressure was 122, diastolic 80, and the pulse-rate was 120. Patient died without operation. At autopsy, two hours and forty-five minutes after death, the macroscopic findings were a medium-sized retrotracheal thyroid, hemopericardium, and right hemothorax with adhesions, and acute parenchymatous degeneration

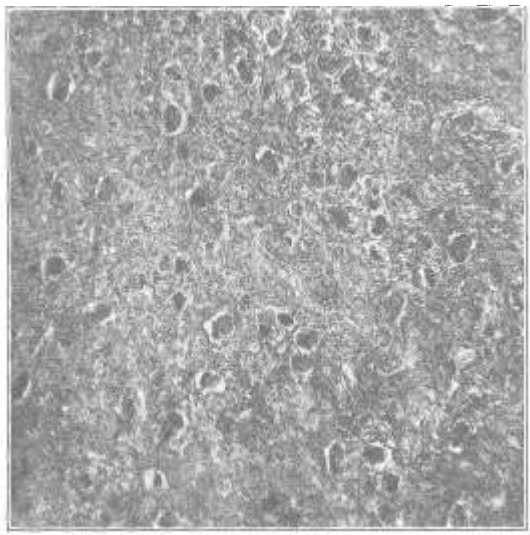

FIG. 5 (Case 9).—Section of right superior cervical sympathetic ganglion, silver impregnation, 10 microns, × 120 diameters. Many normal cells, many hyperpigmented, and a few in advanced stages of degeneration.

with fatty changes in the heart, liver, and kidneys, and chronic nephritis.

Microscopically, the thyroid showed advanced regression on chronic parenchymatous hypertrophy and hyperplasia, Type C–3[7]. The superior cervical sympathetic ganglia showed a marked reduction in the total number of cells. Of those present, many were normal, and a few were in advanced stages of degeneration (Fig. 5).

CASE 10 (A67,759).—The patient, a female, fifty years of age, had had enlargement of the thyroid for twenty years, with mild symptoms of thyrotoxicosis beginning coincident with the thyroid enlargement and lasting for three years. Six months previous to examination, the symptoms of thyrotoxicosis returned. At the time

of examination, the patient was emaciated, the pulse-rate was 200, with a cardiac arrhythmia growing progressively worse. Death occurred three days after examination. At autopsy, one hour after death, the principal macroscopic findings were enlarged thyroid, myocarditis, atrophic and fatty changes in the liver, and chronic nephritis.

Microscopically, the thyroid showed advanced regressive changes in parenchymatous hypertrophy and hyperplasia with some adenomatosis, Type C–3[7]. The superior cervical sympathetic ganglia showed a marked reduction in the total number of cells. Most of those present, however, were fairly normal while a few showed advanced degenerative changes.

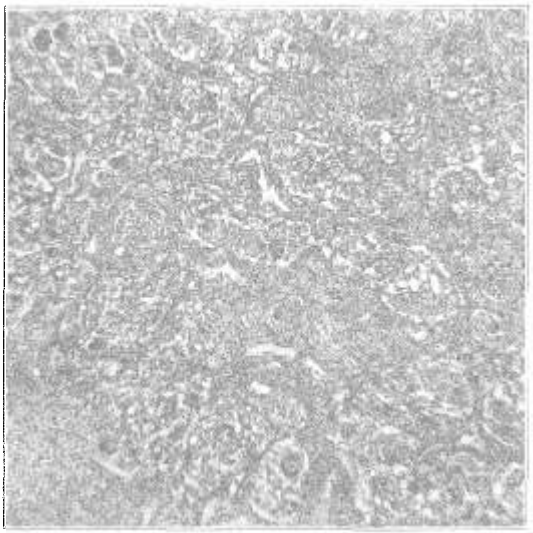

FIG. 6 (Case 11).—Section of left superior cervical sympathetic ganglion, silver impregnation, 10 microns, × 120 diameters. Marked reduction in the number of cells, many normal, and many in varying stages of advanced degeneration; marked increase of fibrous connective tissue.

CASE 11 (A156,404).—The patient, a female, fifty-five years of age, had had thyroid enlargement for twenty-four years. A thyroidectomy of the right lobe was done six years before, followed by a remission of all symptoms until a recent onset of cardiac distress. At the time of examination she had lost weight from 150 to 135 pounds; had a systolic blood-pressure of 158, and a diastolic of 88. The left lobe of the thyroid was extirpated and the internal jugular on the left side ligated. The patient died three days after operation. At autopsy, two hours and thirty minutes after death, the macroscopic findings were marked acute edema of the glottis, moderate hypertrophy of the myocardium of the left ventricle, marked disseminated nodular thickening of the aorta and of the aortic

and mitral valve leaflets, and a moderate sclerosis of the coronary arteries.

Microscopically, the thyroid showed advanced regression of a moderate hypertrophy and hyperplasia, with considerable adenomatosis, Type C–3[7]. The superior cervical sympathetic ganglia showed a marked reduction in the total number of cells. Of the cells present, many were normal, but a large number were in varying stages of advanced regeneration. There was marked increase of fibrous connective-tissue in the ganglia (Fig. 6).

Summary of Protocols.

A study of the preceding protocols shows that of the 11 patients, 7 were females between nineteen and thirty-nine years of age and 4 were females between forty-eight and fifty-five years of age.

When considered in relation to the duration and stage of the symptoms of exophthalmic goiter the cases may be roughly grouped into three classes:

A. Cases still presenting active progressive symptoms of hyperplastic toxic (exophthalmic) goiter. These are as follows:

1. (A156,845) Female, aged nineteen years, symptoms five months, severity 3.*
2. (A153,535) Female, aged nineteen years, symptoms five months, severity 2 to 3.
3. (A136,418) Female, aged twenty-five years, symptoms two years, severity 3.
4. (A144,809) Female, aged thirty years, symptoms eight months, severity 3.

B. Cases in which the severity of the symptoms of hyperplastic toxic goiter had partially subsided, though the acute toxic condition was yet present. These are as follows:

5. (A11,264) Female, aged thirty-three years, symptoms two years, present severity 2.
6. (A149,095) Female, aged twenty-eight years, symptoms six years, severity 3.

C. Cases in which the acute toxic symptoms had almost, if not completely, subsided. These are as follows:

7. (A135,172) Female, aged thirty-nine years, goiter for sixteen years, maximum severity four years ago 3, present severity 1.
8. (A109,170) Female, aged forty-eight years, goiter four years, symptoms five years, present severity 1.
9. (A147,479) Female, aged forty-nine years, goiter thirty-two years, symptoms for two years, present severity 1 to 2.
10. (A67,759) Female, aged fifty years, goiter for twenty years, symptoms during first three years of goiter, then remission until during last six months, present severity 1.

* On a scale of 1 to 5, in which 5 represents the greatest severity.

11. (A156,404) Female, aged fifty-five years, goiter twenty-four years, thyroidectomy right lobe six years ago for doubtful exophthalmic goiter, remission until recent onset of cardiac distress.

The first 4 cases may be grouped with 5 others previously reported[1] in which only the ganglia removed at operation were examined. In these 9 cases of acute progressive hyperplastic toxic goiter, there was very marked hyperpigmentation with extentive granular degeneration, and in some cases atrophy of the ganglion cells.

Cases 5 and 6 may be grouped with three operative cases previously reported.[1] These 5 cases showed considerable hyperpigmentation and granular degeneration, though a smaller number of cells were involved than in the ganglia from the cases of the first group.

Cases 7, 8, 9, 10, and 11 may be grouped with 6 other previously reported[1] operative cases. These 11 cases all showed a very marked regression or complete absence of toxic symptoms at the time of operation or death. In the ganglia from all of these the hyperpigmentation and granular degeneration affected a relatively small percentage of the cells present. In many of the cases, however, a marked diminution in the total number of cells present in the ganglion was shown by sections in series including the entire ganglion.

Discussion.

Thus it will be seen that roughly the degree of hyperpigmentation, the amount of granular degeneration, the atrophy and the reduction in the number of cells was in direct relation to the continuation and subsequent remission of the symptoms of hyperthyroidism. Parallel with this, the perivascular connective-tissue and the connective-tissue stroma generally throughout the gland was increased in direct ratio to the time during which the symptoms of hyperthyroidism had continued. In two of the cases there was marked sclerosis of the ganglionic connective tissue.

Though the present number of cases is too small from which to draw positive conclusions, the observations so far seem to indicate that early in acute hyperplastic toxic goiter there is present in the superior cervical, and probably also in some degree in the other sympathetic ganglia, a process which is causing active stimulation, overfunction, and progressive stages of degeneration in the ganglionic cells. As the symptoms of exophthalmic goiter regress, evidence is found in the ganglia of the cessation of this degenerative process in the ganglionic cells not previously changed past recovery. After the acute toxic symptoms have entirely ceased for years, there remains little evidence of the destroyed ganglionic cells, most of the fatty pigmentary remains of the cells apparently having been absorbed.

The problems of the pathologic changes in the sympathetic

ganglia in man have been obscured in the past by the occasional presence of pigment in the ganglion cells from patients who had exhibited no symptoms of involvement of the sympathetic system. Normally, the cells of the sympathetic ganglia in man are relatively free from pigment until adult life. They then may acquire more or less extensive deposits of brown pigment granules, arranged crescentically about the nuclei. The ganglion cells of patients dying of prolonged wasting diseases, such as tuberculosis and cancer, are apt to show an increased amount of pigmentation and in some instances varying stages of degeneration, hyperchromatization, chromatolysis, and granular degeneration. As control material in these respects many ganglia have been studied by methods parallel to those used on the ganglia from the goiter cases.

CONTROLS.

The control autopsy material is as follows:

1. (A139,228) Eight months' fetus. Placenta previa; atelectasis. Ganglionic cells normal; no pigmentation.

2. (A138,548) Eight months' infant. Pneumonia, following operation for hare lip. Ganglionic cells normal; no pigmentation.

3. (A149,999) Female, aged seventeen years. Pituitary tumor. Death following puncture of corpus callosum. Dilatation of heart; acute nephritis; fatty liver. The lymph spaces around the ganglionic cells are much dilated; the cells are shrunken and hyperchromatic, but not pigmented nor degenerated.

4. (A139,228) Female, aged thirty-six years. Placenta previa; mother of fetus Case 1. Normal; no pigmentation nor degeneration of the cells of the cervical ganglia.

5. (P. B. H. No. 61) Male, aged thirty-four years. Acromegaly; colloid goiter. No pigmentation and no degeneration in ganglia found.

6. (A149,288) Male, aged thirty-five years. Congenital cystic kidneys; hematuria. Some pigmentation, but no degeneration of the ganglionic cells.

7. (38 P. B. H. 3289) Male, aged thirty-eight years. Acromegaly. Some hyperchromatolysis and hyperpigmentation; no granular degeneration of cells found.

8. (A136,199) Male, aged fifty-two years. Carcinoma of anterior wall of stomach; acute parenchymatous nephritis. Autopsy five hours after death. Considerable pigmentation of ganglion cells; no degeneration.

9. (A134,342) Male, aged sixty-four years. Carcinoma of stomach; coronary sclerosis; myocarditis; chronic nephritis. Pericellular lymph spaces of ganglia dilated; cells shrunken; feeble staining; little pigmentation; no degeneration.

The operative control material consists of gasserian ganglia

removed from six patients with trifacial neuralgia in the Mayo Clinic, and from one patient in the Peter Bent Brigham Hospital, and one cervical sympathetic ganglion removed in the Mayo Clinic because of its apparent involvement in a male patient fifty years of age in whom the primary lesion had been a persistent branchial cyst. Although the gasserian ganglia in the 6 cases of trifacial neuralgia and the cervical sympathetic in the branchial cyst case, were all the subject of ganglionic or periganglionic chronic inflammatory changes, and although the patients were from forty-one to seventy-one years of age, in none of the ganglia was there found evidence of such extensive degeneration of the ganglion cells as in the cases of exophthalmic goiter. In all the cases, there was more or less increase of pigment over that found in the ganglia of young adults, but in no case was the amount comparable with that found in exophthalmic goiter cases. Destruction of the ganglionic cells was apparently absent.

Thus it is suggested that neither advanced age, chronic wasting disease, nor chronic inflammatory processes necessarily cause degenerative changes in the sympathetic ganglia resembling those in exophthalmic goiter.

Involvement of Other Ganglia.

The question is suggested whether the involvement of the superior and middle cervical sympathetic ganglia in exophthalmic goiter is but a part of a general metabolic disturbance evidenced by similar changes in the sympathetic ganglia elsewhere in the body, or whether it is confined to the cervical sympathetic ganglia alone. In only 4 cases in which the cervical sympathetic ganglia were shown to be involved have we been able to study the ganglia from other portions of the body. In none of these was there positive evidence of involvement other than hyperpigmentation. There was little or no granular degeneration present resembling that found in the middle and superior cervical sympathetic ganglia. These observations will, of course, need to be confirmed by a much larger series of cases, but they suggest that the ganglionic changes in exophthalmic goiter may be confined largely to the cervical sympathetics, and that they may not be a secondary result of a general metabolic disturbance.

Experimental Work.

With a view to determining the possible relationship of the lesions in the sympathetic ganglia to exophthalmic goiter, studies have been made of the ganglia in a number of animals (dogs, goats, spermophiles, rabbits, and monkeys), in some of which many of the symptoms of exophthalmic goiter had been produced by the administration of Kendall's[6] alpha-iodin compound, in others

which had been subjected previously to double thyroidectomy, and in others in which the cervical ganglia had been injected with various bacteria. In only one animal, however, were suggestive degenerative changes found in the ganglionic cells. In this animal, a young male goat, a small amount of a virulent broth culture of *Bacillus bronchisepticus* (the bacillus associated with canine distemper, and an organism which frequently affects the central nervous system), was injected into the right superior cervical ganglion. The animal died twenty-four days later, and necropsy was performed within an hour after death. The superior cervical sympathetic ganglion from the left side and the stellates from both sides were all apparently normal. The right superior cervical sympathetic, which had received the injection, showed at the immediate site of the injection a small area in which the ganglionic cells were completely destroyed and replaced by necrotic tissue. Throughout the remainder of the ganglion the cells were highly pigmented and showed various degrees of advanced degeneration. In fact, the lesions were quite parallel with those in the cervical ganglia removed from patients with acute exophthalmic goiter.

These experiments are being repeated, and will be made the subject of a subsequent report.

In conclusion, I wish to thank Professors Wm. T. Councilman, Harvey Cushing, and Walter B. Cannon, of Harvard Medical School, for kindly permitting me to examine their ganglionic material from autopsies, operations, and animal experiments.

REFERENCES.

1. Wilson, L. B., and Durante, L. Histologic Changes in the First Sympathetic Ganglion in Exophthalmic Goiter. Jour. Med. Res., 1916, xxxiv, 273–96.

2. Cannon, W. B., Binger, C. A. L., and Fritz, R. Experimental Hyperthyroidism. Am. Jour. Physiol., 1914–15, xxxvi, 363–64.

3. Luden (van Heumen), G. Ueber die Anwendung meiner neuen schnellen Weigert-Modification für Paraffinschnitte, Centralbl. f. all. Path. u. path. Anat., 1912, xxiii, 385.

4. Ramon y Cajal. Trabajos des Lab. de Investigaciones Biologicas, 1910, viii. Rev. trimestral micrografica, xiii.

5. Levaditi, C. Sur la coloration du spirochaeta pallida Schaudinn dans les coupes. Compt. rend. Soc. de Biol., 1905, lix, 326.

6. Bensley, R. R. Studies on the Pancreas of the Guinea Pig. Am. Jour. Anat., 1911–12, xii, 308.

7. Wilson, L. B. The Pathology of the Thyroid Gland in Exophthalmic Goiter. Am. Jour. Med. Sci., 1913, cxlvi, 731, and Trans. Assn. Am. Physicians, 1913.

8. Kendall, E. C. Isolation in Crystalline Form of the Compound Containing Iodin, which Occurs in the Thyroid. Jour. Am. Med. Assn., 1915, lxiv, 2042. Ibid. Trans. Assn. Am. Phys., 1915, xxx, 420.